SOME *X*-RAY PLATES AND THEIR SIGNIFICANCE

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THE *x*-ray machine in our hospital overseas was eccentric. It did its best work when our radiographers had removed most of its internal mechanism including valves and many of these pictures were taken when it was reduced to "a test tube and piece of sealing wax". These lantern slides, the best I could obtain from the *x*-ray plates, still leave something to imagination.*

Here are two slides only of the renal pelvis. There are many others; but some are not of sufficient interest and others are altogether too much of the impressionistic school.

Plates 1, 2, and 3 right renal pelvis, left renal pelvis, transverse colon.

This young soldier complained of disabling pain across the small of the back, over frequency of urination by day and night and at times urgency even to incontinence on overholding his urine. Periodically he had acute pain in the right iliac fossa with vomiting, urinary tenesmus, and chills.

These symptoms he attributed to, and dates from, an accident five years before, when a block of wood was driven into the lower abdomen and he passed blood per rectum. Two laparotomies were then done but no further particulars were obtainable.

He was "pot-bellied". There was tenderness over both renal regions before and behind and over the fuller lower abdomenal quadrants. The kidneys were not palpable in their usual positions and the lower abdominal muscles offered too much resistance to

* It has been found impossible to illustrate this paper from the lantern slides themselves. Resort to semi-diagramatic reproductions is therefore necessary.

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manual examination for one to get any information worth while by this method.

The *x*-ray revealed the right kidney occupying a position four inches lower than usual. Its pelvis, however, appears normal until contrasted with the left renal pelvis with its bizarre long upper calyx, longer lower calyces and smaller pelvis proper.

The left kidney was also prolapsed but to a less degree than the right. There was general enteroptosis as well, although the stomach specialist (Capt. Cleaver) found the intestines functioned properly.

The ache in the back and reflex urinary symptoms were due to drag on the renal pedicles.

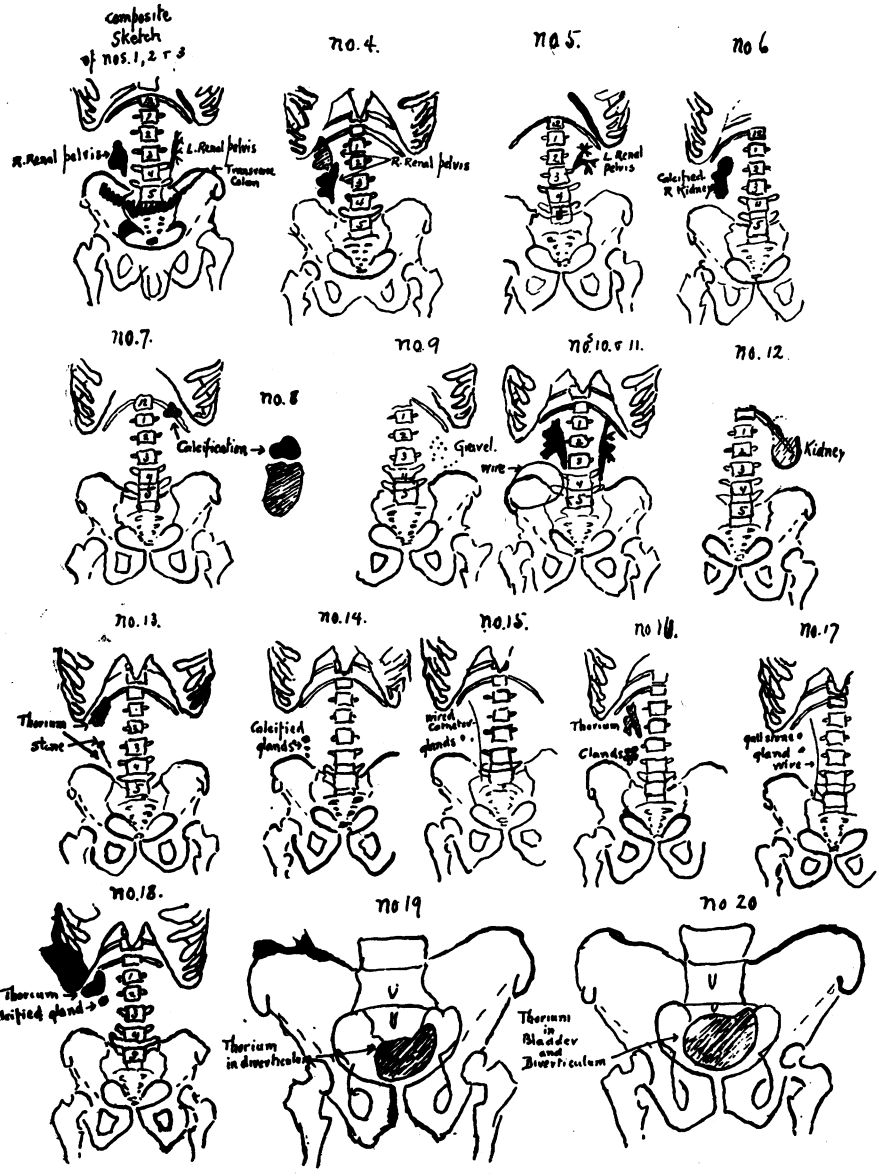
The right renal colic was due to the movable kidney at times getting into a position which interfered with the outflow of its urinary excretion.

4. This plate shows how the kidney position may vary with extraabdominal pressure. The dotted line shows the right kidney in place when an inflated rubber bag was interposed between the *x*-ray tube shield and the abdomen, the unbroken line (traced on from another plate) gives its place when no pressure was used.

These club-shaped calyces suggest septic erosion but no indication of when this occurred could be obtained from the man's history. It may have been that the pyelitis of infancy was at the bottom of it. During the time he was under my care no pus whatever was found on repeated urine examinations. I removed the kidney which proved to be nothing but a shell. The urinary symptoms this man complained of were so varied in essential details and contradictory that at one time he was looked on as very probably malingering. Unfortunately I do not know his history subsequent to operation.

5. The *x*-ray was instrumental in this case in excluding stone. The left renal pelvis and calyces were normal notwithstanding that this officer had two attacks of renal colic referred to this side during the two weeks he was in the hospital for other urinary complaints. It is probable that this colic was referred from the right kidney as its ureteral orifice was œdematous and would not admit a ureteral catheter before his symptoms subsided and he rejoined his unit.

6. This is the renal plate of a man who was being returned to Canada as an experienced farmer. He was forty-eight years old and had seen thirty-three months of service at the front. He was referred to my department, en route, to see if anything could be done for his general rheumatic pains, slow urinary stream, over-


Composite Sketch of nos. 1, 2 & 3
R. Renal pelvis
L. Renal pelvis
Transverse Colon
no. 4.
R. Renal pelvis
no. 5.
L. Renal pelvis
no 6
Calcified R Kidney
no. 7.
Calcification
no. 8
no. 9
Gravel.
wire
no. 10 & 11.
no. 12.
Kidney
no. 13.
Thorium
stone
no. 14.
Calcified glands
no. 15.
wired Catheter
glands
no 16.
Thorium
Glands
no. 17
gall stone
gland
wire
no. 18.
Thorium
Calcified gland
no 19
Thorium in diverticulum
no 20
Thorium in Bladder and Diverticulum

frequency of urination and urgency to incontinence on overholding his urine. His father died of tuberculosis. He had tubercular posterior urethritis and prostatitis, and this plate reveals a calcified right kidney.

7. This is the left renal region of a man "buried" at Vimey two and a half months before and sent to our clinic with a diagnosis of fractured left transverse process of second lumbar vertebræ and renal calculi. His only symptoms were attacks of intimate hæmaturia and pain across kidneys which stabbed to the left testis at times—no pyuria was ever reported and he never had any symptoms of genito-urinary derangement whatever, although twenty-nine years of age, until Vimey Ridge battle. One sister died of tuberculosis.

8. Is an *x*-ray of this left kidney after removal. It is a similar kidney to the one depicted in Plate 6; but in this case the calcification was strictly limited to the upper pole and nothing but tradition held one from doing a partial nephrectomy.

9. This soldier's medical history sheet recorded that on two occasions he had had stones removed from the left kidney, and my assistant assured me that he had been present at the last operation and wondered at the time why nephrectomy was not done instead of nephrotomy. The patient complained only of a sinus in the loin which kept his back wet and required dressing. This plate shows crumbs of stone in the renal region. A thick slab of scar tissue was dissected out of the flank and in it were demonstrated the renal calyces to every one's satisfaction. The ureter was carefully tied off and the mass removed. On further inspection of the fundus of the wound a Staffordshire knot presented. This discovery I kept to myself; and afterwards reinspected the specimen removed only to discover that the supposed kidney was scar tissue only and its calyces diverticulæ of a sinus. This case is reported as one of those surgical varieties capable of demonstration at operation, although it is not there.

10. This young soldier had been in and out of hospitals for six months with diagnoses either of "right renal colic" or "nephritis". He had lost thirty pounds in weight and at times had had pus and casts in his urine; at other times the urine was reported free of all abnormalities for prolonged periods. He had never vomited and there was no record of a temperature over 99·4°. At times there had been marked frequency, scalding and urgency of urination but there was no venereal history. At times there had been pain in the appendix region but usually the pain was located

in the right costovertebral angle area. A large somewhat movable mass with the outlines of a large kidney was palpable in the right lower abdominal quadrant. This was outlined by flexible wire, the right renal pelvis filled with thorium and an *x*-ray taken which suggested that the kidney could not form any part of the palpable mass.

11. The chief in surgery, however, was not convinced, and the pelvis of the left kidney was *x*-rayed. By contrast it appeared to have longer and slimmer calyces inviting the opinion that the right kidney was mobile and subject to internal intermittent back pressure. At the direction of the officer in charge of surgery an apparently normal right kidney was exposed; but the mass of dense scar tissue below it called for a general surgeon and he took over the case. In the centre of the mass which he dissected out was found a retrocæcal appendix. The condition then was chronic appendicitis with a spread of the infective micro-organism to the right renal pelvis. The urinary symptoms were reflex.

12. It was a red letter day for us when we got this plate showing the lower pole of the left kidney. A skilled operator with an up-to-date machine can duplicate it or do better on every exposure. Since my return I have seen even such soft tissues as the gall and urinary bladders outlined on *x*-ray plates.

13. The thorium in this case maps out a right pyonephrosis and the ureter up to a stone at the highest narrowing of the ureter. Between the stone and kidney substance no shadow appears indicating that the renal pelvis is contracted down to a passage only large enough to allow the thorium to pass up without volume sufficient to cast a shadow at this place. The kidney was removed by morcellement; but at that time the stone could not be found nor the passage to it made out in the dense sclerosed mass which occupied the position of the renal pelvis.

14, 15, 16, 17, and 18 are plates of calcified retroperitoneal glands which may easily be mistaken for urinary calculi. They probably originate in tubercular adenitis and often there is inflammation more or less acute surrounding them which involves the ureter and partially occludes it causing hydronephrosis. On the other hand the infecting agent passing through the lymphatics from this focus to the right kidney may set up pyelonephrosis or even pyonephrosis, so that the symptoms of these periglandular inflammations are often renal in character and the finding of opaque bodies in this neighbourhood by means of the *x*-ray leads to a mistaken diagnosis of stone.

14. This man's urine contained pus and blood and he suffered from typical renal colic. Diagnosis of extra ureteral obstruction was confirmed by laparotomy, when some of the calcified nodules were removed.

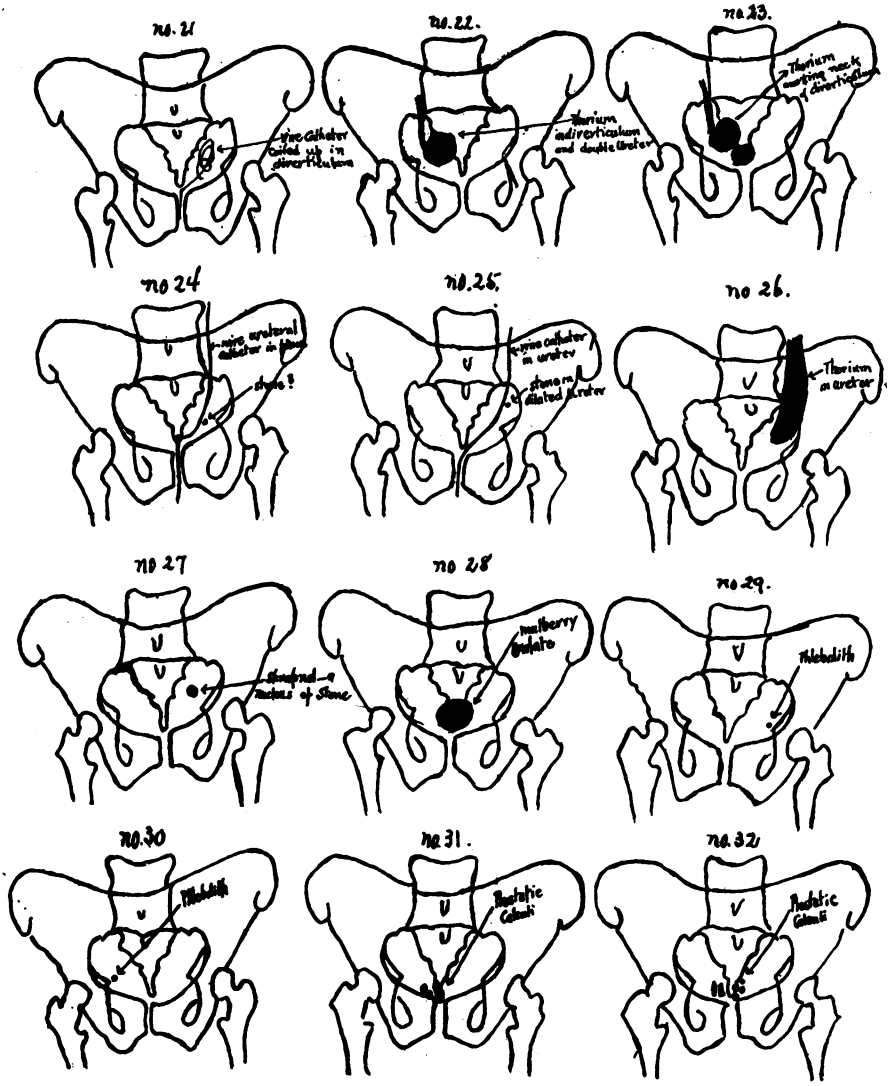
15. This man also suffered from typical renal colic but his urine was normal. Diagnosis was made by placing an opaque catheter in the ureter and demonstrating its distance from the concretion.

16. Shows the relation of such a group of glands to the renal pelvis when filled with thorium solution. On laparotomy, done by the officer commanding the unit, a retrocæcal appendix and some of the calcified nodules were removed, indolent tubercular peritonitis was found. There was no call for removal of the right kidney as the left kidney, bladder, and prostate were involved as well.

17. Shows the relation of a stone to a ureteral catheter in a man who had had right renal colic and in whose urine blood and pus were present. No operation was done overseas, but since this man's return to Canada I have some reason to believe that an attempt was made to remove renal calculus after another x-ray had demonstrated the same relation of this opaque body to the catheter. It was assumed that the stone was in a lower renal calyx. I do not think this was a case of renal calculus at all. The opaque body is more lightly shaded in the centre, a peculiarity of gall stones and on this plate (subsequently confirmed) are light opacities outside the line of the ureter which I take for calcified glands. In confirmation of this opinion plate, 18. Shows that the renal pelvis mapped out with thorium does not extend to the supposed renal calculus. Moreover nothing is more probable than that inflammation about calcified glands would extend by the lymphatics not only to the right renal pelvis but to the gall bladder as well.

19. Shows a diverticulum of the bladder filled with opaque solution. The case is interesting because the congenital bladder condition gave no obtrusive symptoms till after the man had had his abdomen peppered with shrapnel and then apparently infection of the diverticulum set in; also because on the other side of the bladder there was a congenitally stenosed and prolapsed ureteral orifice which had to be slit larger, and finally, because transplanting of the ureter on removal of the diverticulum, was followed by infection of the kidney on that side requiring nephrectomy.

20. This case shows the bladder outlined with opaque solution


no. 21
Fine catheter coiled up in diverticulum
no. 22.
Thorium in diverticulum and double ureter
no. 23.
Thorium marking mouth of diverticulum
no 24
Fine ureteral catheter in place
stone?
no. 25.
Fine catheter in ureter
stone in dilated ureter
no 26.
Thorium in ureter
no 27
Showing outlines of stone
no 28
mulberry calculus
no. 29.
Phlebolith
no. 30
Phlebolith
no. 31.
Pelvic Calculi
no. 32
Pelvic Calculi

in the same case. The irregularity in its outline is due to the full diverticulum showing itself beyond the bladder outline.

21. This shows a wired catheter which was fed up the opening of the diverticulum and coiled up inside it when an attempt was made to catheterize the ureter which opened into the diverticulum.

22. This is another collargol filled diverticulum. The dilated ureter which entered it at operation was found to be double barrelled.

23. This is of the same case the bladder filled first with opaque solution, let stand awhile and then presumably emptied by urination; but the plate shows residual solution in the bladder as well as a full diverticulum. This man after fourteen months of service at the front reported ill with undue frequency of urination, urgency, scalding and pain over the bladder and right kidney behind. The appendix had been removed but beyond the scar there was no palpable evidence of the condition and the urine was normal in every way including freedom from pus on repeated examinations.

24. Although this man gave a history of attacks of renal colic for many years his story was not very convincing and there were several inconsistencies in it. On one occasion a few pus cells were undoubtedly found in the urine from the left kidney, but voided specmens were repeatedy reported normal in every way On *x*-ray the relation of the ureteral catheter to the pelvic opacity showing on this plate proved to our satisfaction then that he had no stone. I am not so sure now that no ureteral stone was present.

25. Shows a similar relation of catheter to an opacity, but 26, before taking which collargol was injected into the lower ureter demonstrated a pouch in which a stone could lie at some distance from a ureteral bougie in place and that such was the case was confimed by scratches on a waxed bougie which was passed up. This soldier wxs anxious to return to his unit at the front and insisted on being marked grade "A". We held him only long enough to do a ureteral meatotomy through a cystoscope and hope that the next time the stone left its bed and engaged in the channel proper it passed through the enlarged ureteral meatus into the bladder and out with little pain.

27. Here is a bit of shrapnel about which stone has formed. It was left when the rest of his collection in face, abdomen, scrotum, and legs was removed and his attention was not directed to it till some weeks later when it tried to pass into the posterior urethra. It retreated then and when it was removed a year later we found it had grown an overcoat. This overcoat contains phosphates

and so I presume there was infection. I have an oxalate stone formed about a stitch passed through the bladder at herniotomy. I think the oxalate stones depend on blood for a matrix (especially the fibrogen part of blood)—the phosphates on a slime made up of mucinogen acted on by ammonia producing micro-organisms. I believe the matrix is the primary and essential factor in all stone.

28. Is a picture of a mulberry oxalate in situ in the upper division of an hour-glass bladder. I am passing it around. To cystoscopy this was a most astonishing stone. It seemed to float. One looked up towards the roof of the bladder to see it. Even the dense shadow shown on radiography was not deemed enough to clinch the matter and when the bladder was exposed at operation it was needled to determine if the thing were not a stone-encrusted tumor growing down from the apex. After removal some fleshy bits from its bed were reported to be papilomatous by Captain Fiedler, our pathologist. Some months later I had the good fortune to cystoscope this case again when a definite waist to the bladder could be clearly made out although it was not demonstrable at the cystotomy.

29 and 30. Here are two plates showing phleboliths. These vein stones are said to occur only in the plevic plexus and appear to be independent of phlebitis for an origin. They are found with increasing frequency from the fourth decade onwards and are demonstrable by the x-ray in most men over sixty. They are symptomless and so far as I can learn of no pathological significance.

31. This man had just had a whip bougie passed for retention and ureteral fever followed. Some years previously he had had atypical right renal colic and passed gravel. Later he had had gonorrhœa and more recently terminal hæmaturia. These opacities removed supra-pubically were some of his phosphate gravel lodged in the posterior urethra, pocketed and grown in situ to obstructive size.

32. This plate on the other hand depicts true prostatic calculi. There was no history of renal colic, no alkaline urine, and the "second glass" was free of pus. There was a history of chronic sclerosing prostatitis of many years' duration to choke the outlet of the prostatic ducts and cause retention and amalgamation of their contents.